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LAPAROSCOPIC GRADUAL TRACTION OF THE TESTICULAR VESSELS IN CASE OF IMPALPABLE UNDESCENDED TESTES

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ABSTRACT

Background: Most undescended testes are palpable, but around 20% of cases are reported as non-palpable, and these represent a major challenge as regards determining the most effective strategy for diagnosis and treatment. About 3% of full-term and 30% of premature infant boys are born with at least one undescended testis; making cryptorchidism the most common birth defect of male genitalia .

The aim of work is to evaluate a newly described vessel sparing technique (gradual traction method) for treatment of high impalpable undescended testes and to assess value of laparoscopy in diagnosis and treatment of various types of impalpable undescended testes.

Patient and methods: This study included 28 patientswho presented with 30 impalpable testes to the outpatient clinic of fayoum university hospital in July 2013-January 2016, and underwent laparoscopy by the same surgeons. Intra-abdominal testes were managed by standard inguinal orchiopexy if intracanalicular or peeping, laparoscopic orchiopexy if low and staged traction (Shehata technique) if high. Children were evaluated postoperatively to check the location and size of the testicle and to exclude any other complications.

Results: Mean age at presentation was 8.90years (range 1-20years). Follow up was 6-18 months (mean 10 months). On follow up, the testes were normal sized and well positioned in the scrotum in all testes in the orchiopexy and traction groups with an overall success rate of 100%. One testis slipped off the traction stitch and was converted to a staged Fowler-Stephens procedure.

Conclusion: For high level undescended testis and when one-stage mobilization is difficult, staged traction orchiopexy (Shehata technique) has excellent results.

KEY WORDS: Gradual traction-Testicular vessels- undescended testis.

Introduction:
Cryptorchidism means a hidden testis as in Greek cryptos means hidden and orichis means testis. This occurs when the testis fails to descend into scrotum. About 3% of full-term and 30% of premature infant boys are born with at least one undescended testis; making cryptorchidism the most common birth defect of male genitalia. However, most testes descend by the first six months of life (the majority within three months), making the true incidence of undescended testis around 1% overall [1]. Early correction, at 6 months of age, is currently advised[2].
Undescended testis (UDT) is associated with reduced risk of fertility and increase risk of testicular Germ cell tumors [3].

Diagnosis of undescended testis is based on clinically at birth, pelvic ultrasound or MRI is used to determine can often but invariably locate testis. Hormonal levels as gonadotropins can confirm that there is hormonally functional testis worth attempting of rescue [4].

Laparoscopy has gained popularity, not only as a diagnostic modality in evaluating boys with impalpable testes, but also as a therapeutic modality in the management of the non palpable undescended testis[5].

Based on the laparoscopic findings in patients with impalpable testes, the following subgroups can be defined[6]:
Type I: no testis seen on laparoscopy;

Type II: vas and vessels enter the ring and loop back to a testis sited at the internal ring;

Type III: vessels do not enter ring, but enter a testis lying at internal ring; type IV: testis is intra-abdominal, not related to the internal ring.

Although the management of boys with palpable testes has been standardized, there are no formal guidelines for the management of boys with nonpalpable testes[7].In our study we evaluate a newly described vessel sparing technique (gradual traction method) for treatment of high impalpable undescended testes and the value of laparoscopy in diagnosis and treatment of various types of impalpable undescended testes.

Patients and methods:
This study is a prospective study, performed on 28 patients with 30 non palpable undescended testes. The patients were treated in the surgery Department of Fayoum University Hospital over a period from July 2013- January2016.

Informed consent was obtained from either the parents or guardians for all cases. Approval by the ethical committee of the faculty of medicine, University of Fayoum was obtained.

Inclusion criteria: all patients with impalpable undescended testis at any age above 6 months.

Exclusion criteria: we excluded
- patients with palpable undescended testis
- patient age below 6 months
- Any associated congenital anomalies(cardiac, cerebro-vascular..etc) due to non availability of post-operative pediatric surgical ICU.

Upon laparoscopy the impalpable testes were divided into 4 subgroups according to operative finding and used surgical technique .

Type I: no testis seen on laparoscopy ;

Type II: vas and vessels enter the ring and loop back to a testis sited at the internal ring ;

Type III: vessels do not enter ring, but enter a testis lying at internal ring ;

Type IV: testis is intra-abdominal, not related to the internal ring.

We took a history from all patients about the present illness and history of previous operations ,all patients were examined generally and local examination was performed for all patients for inguinoscrotal region, routine preoperative laboratory investigations were done and inguinoscrotal ultrasonography was done to confirm the diagnosis.

Surgical procedure:
All patients took general anesthesia then exploration of the abdominal cavity was started with the patient in supine position. Failure to visualize the spermatic vessels and or vas deferens demands for a 20–30° head-down position and rotation of the table to the side contralateral to the place of interest.

The surgeon was on the left side of the patient with the scrub nurse at the surgeon's left and the assistant on the opposite side. The column with monitor, light source, CO2 insufflator, and recorder is positioned at the bottom of the table.

Standard laparoscopy equipment was used. 5mm optic was used and in older patient 10mm optic was used.

Since the umbilicus in infants was contaminated, and sometimes filled with hard incrustations, preparing the umbilical region is important in order to avoid omphalitis.

we used an open technique for the insertion of the first trocar. We preferred a transumbilical approach, with a vertical incision. The cannula was secured with a purse-string suture. After insertion the cannula, the sutures were crossed and tightly twisted, which prevents leaks. At the end of the procedure, the suture was tightened to close defect.

Insufflation pressure was approximately 8 mmHg in infants and 10 mmHg in older children with a flow rate of 0.5–1 L/min.Two more 5mm incision were made lateral to the rectus muscle and below the umbilicus through which a two instruments introduced directly without ports into the peritoneal cavity under telescopic vision, due to thin abdominal wall and no availability of short trocar (portless technique)**(Fig.1)**.

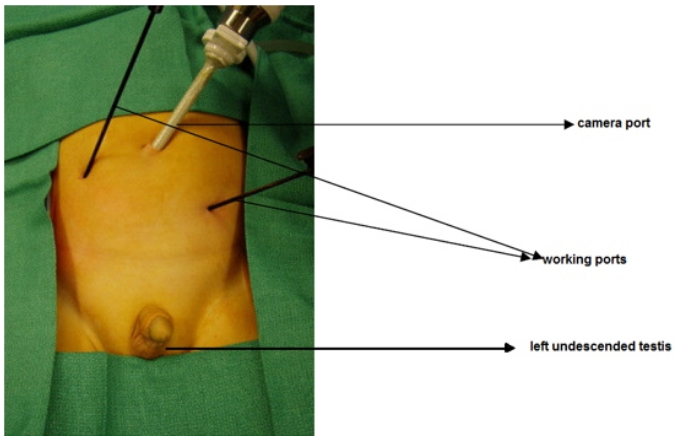

Fig.1. Port sites

Findings and further procedure

I) Atrophic(vanishing)/absent testis:

Closed internal ring with blind ended vas and absent or attenuated vessels. No further procedure was done.

II) Intracanalicular(peeping testis):

The testis lies at the internal inguinal ring. External compression of the inguinal region pushes the gonad in the abdominal cavity where as the traction on the scrotum "milks" the testis into the canal.

Standard open inguinal orchiopexy was carried out in these cases. After the laparoscopy was aborted.

III)Low intraabdominal testis with long vessels :

Evaluation of the length of the spermatic vessels requires the introduction of a second working instrument. A gonad which can be manipulated up to the contralateral inguinal ring (stretching maneuver) **(Fig. 2)** was subjected to laparoscopically assisted orchiopexy **(Fig. 3)** .

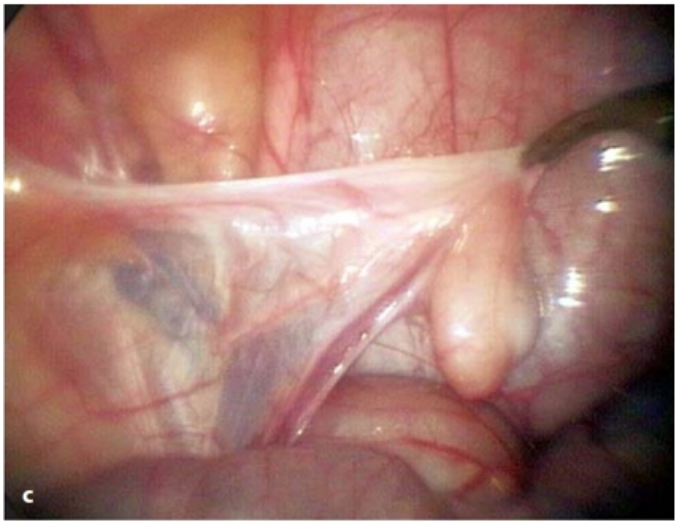

Fig.2. Stretching maneuver.

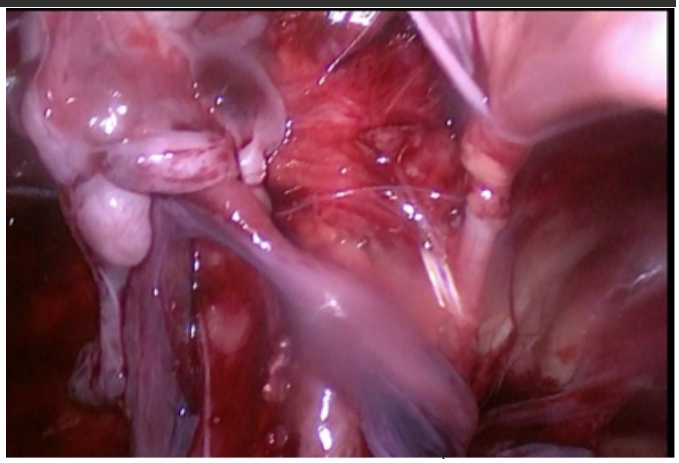

Fig.3 a:Manipulation of the testis through the internal ring

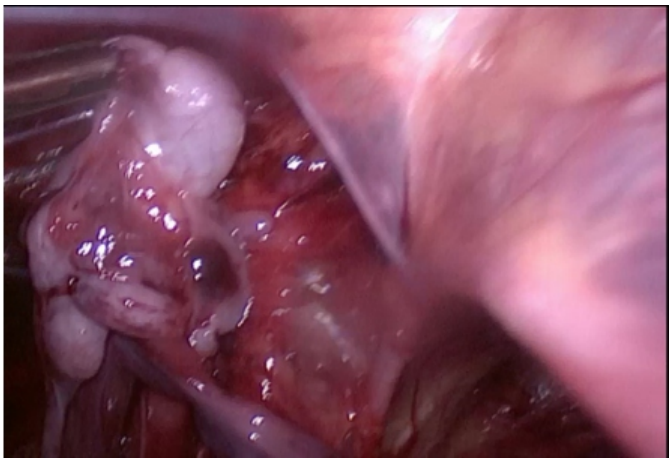

Fig.3 b:Manipulation of the testis through the internal ring

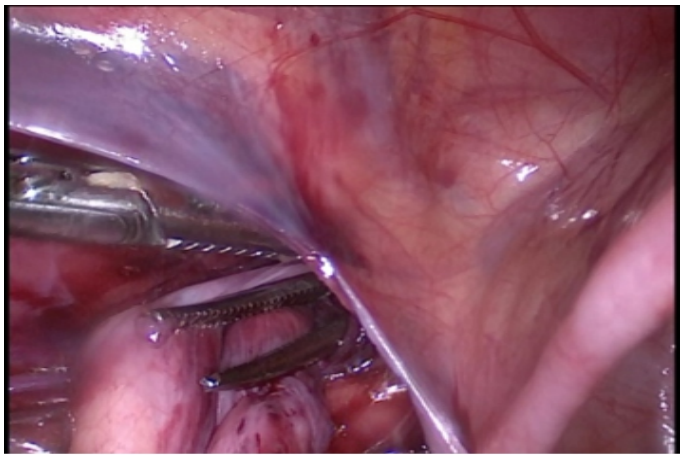

Fig.3 c:Manipulation of the testis through the internal ring

IV) High intraabdominal testis with short vessels:

If the testis can't be manipulated to the contralateral inguinal ring (stretching maneuver)it was subjected to laparoscopic traction then interval laparoscopic assisted orchiopexy.The testis was mobilized by division of the gubernaculum and the peritoneum lateral to the vessels.

A Prolene stitch (2/0) was passed from outside the body, 2 cm above and medial to the anterior superior spine (ASIS) on the contralateral side. The needle was received from inside by a laparoscopic needle holder, passed through the tunica albuginea of the lower pole of the testis and gubernaculum and returned back to exit from the same point of entry. The free ends of the Prolene stitch were then tied after deflation of the pneumoperitoneum, maintaining only a minimum degree of tension.

A second laparoscopy was performed after 3 months. The Prolene stitch divided and the testis was brought through a new hiatus at the level of the medial umbilical ligament i.e. Prentiss maneuver **(Fig.4)** was used to shorten the way down to scrotum through dissection lateral to bladder wall and medial to medial umbilical ligament then an instrument was introduced until it was palpated within the scrotum from outside. The scrotum was incised at this site. The instrument was fur-

ther inserted until it was seen from outside. A second forceps was inserted from outside into the scrotal pouch and advanced upward via the inguinal cannel until it enters the abdominal cavity. The testicle was grabbed and pulled all the way down into the scrotum. The opening in the fascial button hole can be narrowed with one or two sutures, so the testis does not retract upward. A subcutaneous pouch was made in the scrotum by an artery forceps. The scrotal,abdominal and umbilical incisions were closed.

Success was defined as a scrotal testis without atrophy. Confirmation was carried out by color Doppler ultrasound to check on the testicular vascularity. Results are expressed as means ± SD. Significance is obtained with Analysis of Variance (ANOVA).

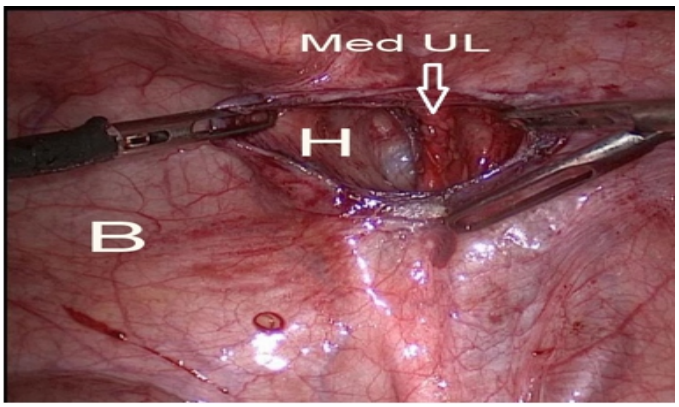

Fig.4. Prentiss maneuver. H: neo-hiatus; B: urinary bladder; Med UL: right medial umbilical ligament.

Informed consent: Informed consent was obtained from all individual participants included in the study.

Results

The study included 28 patients with 30 non palpable undescended testes. According to intra operative finding the testes was divided into 4 groups

Group I: absent testes in which no further steps done.

Group II: intracanalicular or peeping testes in which open orchidopexy done.

Group III: testis related to internal ring with long vessels includes in which laparoscopic assisted orchidopexy done.

Group IV: testes related internal ring with short vessels or pelvic testes in which laparoscopic traction done and arranged for 2nd operation of laparoscopic assisted orchidopexy.

The results were evaluated postoperatively at 2 weeks, second and sixth month regarding presence of scrotal testis without atrophy. Confirmation was carried out by color Doppler ultrasound to check on the testicular vascularity.

Mean age at presentation was 8.90years (range 1-20years).

Upon laparoscopy:

Group I: absent testes :

These included 8 testes in 7 patients. In 5 patients there was vanishing vessels, blind ended vas and closed internal ring **(Fig. 5)**; No inguinal exploration was done.

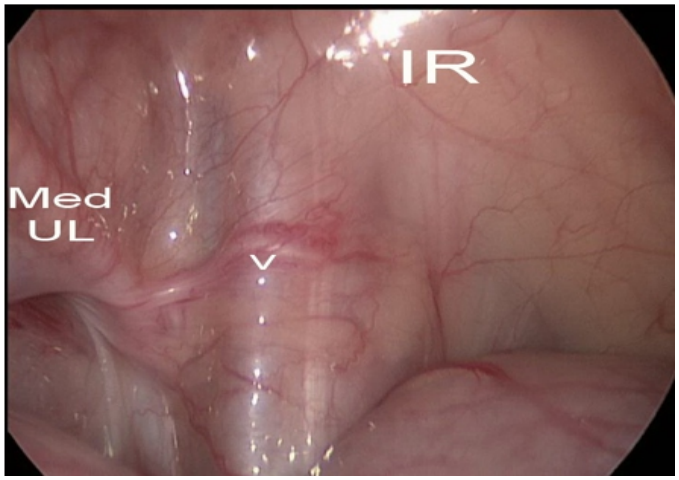

Fig.5: Vanishing right testis. V: blind ended vas; IR: closed internal ring.

In one patient 10 years old with left unilateral undescended testis there was vas and vessels entering closed internal ring and had history of previous ipsilateral inguinal exploration at age of 5 years at another hospital **(Fig.6)**; No more procedures were done.

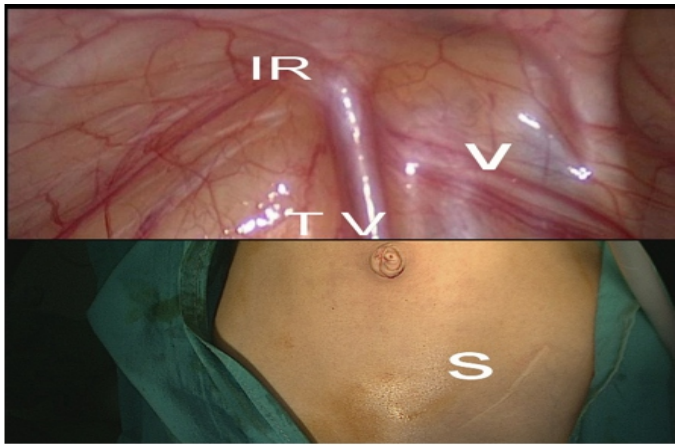

Fig.6: Absent left testis with negative inguinal and laparoscopic exploration. IR: closed internal ring; TV: testicular vessels; V: vas deferens; S:scar of previous inguinal exploration

One patient (13 years old) with bilateral vanishing testes had history of open inguinal exploration at age of 6 years at another hospital.

Group II: intracanalicular testes:

These included 7 testes in 7 patients. The laparoscopy showed either intracanalicular testes or peeping testes with looping vas and vessels **(Fig.7)**. Laparoscopy ended and shift to open inguinal orchidopexy was done. In one patient there was epididymo–testicular dissociation so biopsy taken and the gonad fixed in inguinal canal; the biopsy result was " gonadal streak" so gonadectomy done 2 weeks later.

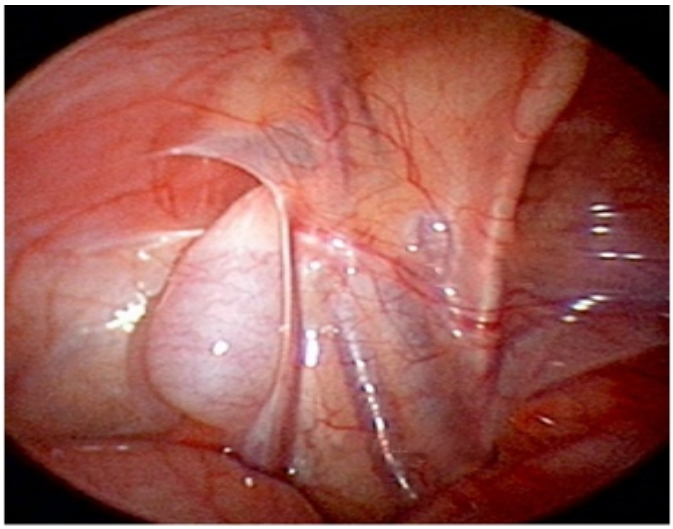

Fig.7:Intracanalicular testis

Group III: testis near internal ring with long vessels:

This group included 9 testis in 9 patients in which laparoscopic assisted orchidopexy was done **(Fig.8)**.Follow up period ranged between 6-18 months with fair size and site -mid scrotal- of testes with no atrophy or recurrence.

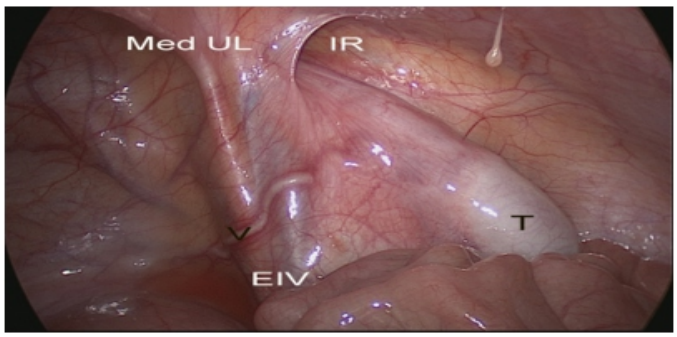

Fig.8: Testis related to internal ring. T: right testis; IR: internal ring; external iliac vessels; Med UL: medial umbilical ligament.

Group IV: testes with short vessels:
This group includes 6 testes with short vessels **(Fig. 9)** in 5 patients so traction done and arranged for 2nd operation of laparoscopic assisted orchidopexy.

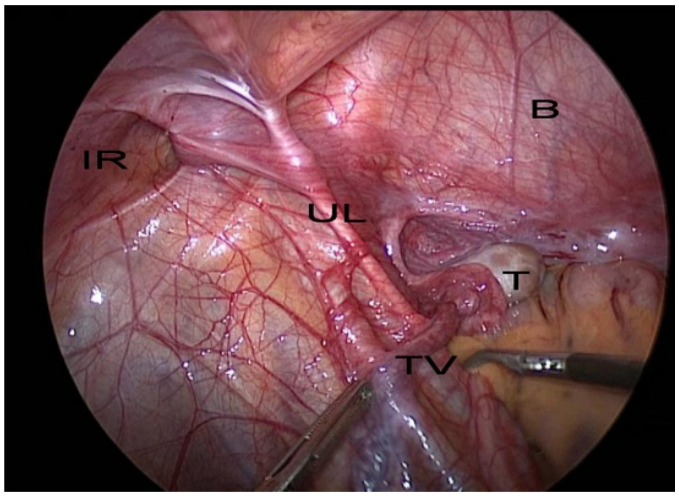

Fig.9 : Pelvic left testis. T: left testis; UL: medial umbilical ligament; B: urinary bladder; TV: testicular vessels; IR: internal ring.

The 2nd operation was after 3-6 months in which the vessels were elongated **(Fig.10)** and laparoscopic assisted orchidopexy became feasible. No incidence of internal herniation or mechanical intestinal obstruction occurred. Five testes were placed in the scrotum without tension **(Fig.11)**. One testis slipped off the traction stitch and was converted to a staged Fowler-Stephens procedure.

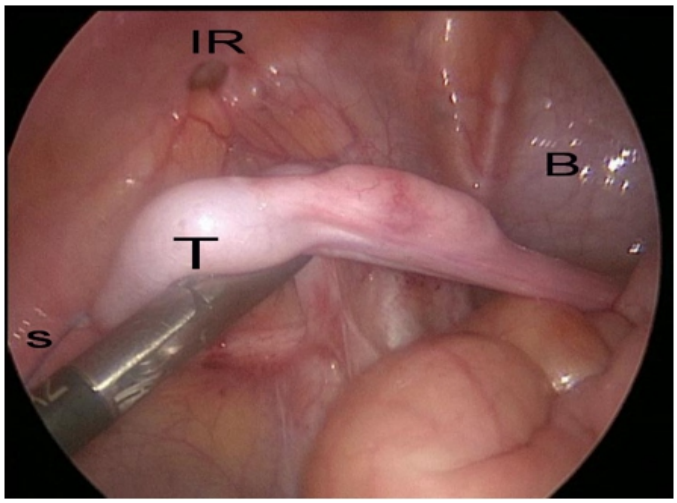

Fig.10: Elongated vessels after intra abdominal traction. T: right testis; IR: open left internal ring; S: traction suture; B: urinary bladder.

(Fig.11): Testis reaching mid scrotum after traction.

Hospital Stay:
All patients (28 patients) stayed in hospital overnight and discharged next day. No post operative intra venous fluids were given. No anti emetics were given both in diagnostic group (6 patients) or the therapeutic group. No post operative fever or vomiting was occurred.All patients were given a report and a recorded copy of laparoscopy.

Follow-up:
The mean follow-up period was 10 months (6 to 18 months). The testes were of good size, viable and in good scrotal position (detected by clinical examination and color Doppler US).

In patients with unilateral vanishing absent testes no further follow up was done. The patient with bilateral vanishing testes was referred to pediatric endocrinology department.

In the traction group the location of the testes was low scrotal in two, mid scrotal in three and high scrotal in two.

No inguinal or port-site hernias were detected at follow up.

Discussion
The main goal of surgical treatment of cryptorchidism is to mobilize the testis down to the scrotum without inducing iatrogenic testicular atrophy.Up to now, the best operative intervention for high intra-abdominal testes has not been standardized [7,8,9].
The recent recommendation is to perform orchiopexy at age between 6-12 months [2]. Huston [10] advised early correction at 3-9 months of age as germ cell loss begins at 3–6 months in UDT; rarely spontaneous descent occurs after 3 months. Abouzeid et al. [11] studied histological alterations in intra-abdominal testes in relation to patient age at orchiopexy and have provided important evidence regarding germ cell depletion being directly related to the age at orchidopexy.

In a retrospective study done in UK by Bradshaw et al.[12] they concluded that early orchidopexy is not yet achieved due to late referral from primary care centers. They recommend earlier primary care referral directly from the routine postnatal check to a centre prepared to undertake surgery in this age group.

The treatment of non-descended testicles is mandatory due to the increased risk of infertility, present in up to 40% of the patients, as compared to 6% of control groups, in addition to malignancy, which reaches 20 times that of normal adults [13].

Although fertility is already compromised in the older age group,orchiopexy before 10–11 years may protect against the increased risk of testicular cancer associated with cryptorchidism[14].Treatment is necessary not only for the risk of malignancy, but also for the improvement in the quality of the patient's life and parents' concern for their children's health[15].

Laparoscopy has been established as the most reliable diagnostic modality for the management of impalpable testes. It has proven to be a very accurate diagnostic with high safety [16-18].

When a testis is impalpable, possible laparoscopic findings include (1) abdominal location (25% to 50%), (2) complete atrophy ("vanishing" testis, 15% to 40%), and (3) intra canalicular location but nonpalpable (10% to 30%) [19].

Sweeney et al. determined three main locations of impalpable testes: 40% of all impalpable undescended testes are located intraperitoneally; 15% are vanishing testes; and 45% have cord structures entering the internal inguinal ring [20].

Ang and Forrest reported in their study that 25.3% of impalpable testes were identified intraperitoneally, 18.9% were absent, and 21% were at internal ring and 29.5% intracanalicular [21].

With the diagnosis of vanishing testis, it has been argued about fixation of the contralateral testicle as a safeguard against testicular torsion of the solitary testicle. Bellinger[22] described the presence of a bell-clapper deformity in 83% of children with a vanishing testis whose contralateral scrotum was explored. However there is no wide agreement on the need for contralateral fixation in this situation[23].

In our series there were 5 impalpable testes with atrophic vessels, blind ended vas and closed internal ring i.e. vanishing testis in which no inguinal exploration was done.

In our study no contralateral orchidopexy done in patients with vanishing testis. As clinical torsion of the solitary testis is such a rarely reported event and the risk of exposure and fixation of an otherwise healthy testis may be as significant as the risk of eventual torsion [23]

Shadpur et al., performed laparoscopic exploration which identified 7 testes out of 19 testes (recorded as absent); after initial open surgery which had failed to locate the gonad [24].Barqawi et al., identified 9 testes out of 30 testes recorded as

absent (one of them was malignant); after previous inguinal and open exploration surgery[25]. They recommended laparoscopic re-evaluation in patients with nonpalpable testis and history of negative open exploration.

In our study there were two patients with previous open surgery denoting absent testes; one of them has history of inguinal exploration for unilateral undescended testis and the other has history of bilateral inguinal exploration and open mid-line exploration. Upon diagnostic laparoscopy no intra abdominal testis found.

For the 'peeping' low intra-abdominal testis an open standard orchiopexy, following the diagnostic laparoscopy may be an option. However, laparoscopy-assisted orchiopexy has now become a widely used standard in treatment most variants of intra-abdominal testis [26].

Some authors perform open inguinal orchidopexy for peeping testis where vas and vessels enter an open inguinal ring [7,27,28]. While many other authors recommended primary laparoscopic orchidopexy[29,6,17,23,30,31].

In our study open inguinal orchiopexy for peeping testes has yielded good results, as shown by testicular size and position.

Orchidectomy usually is recommended for atrophic gonads and for postpubertal patients with unilateral abdominal testicles [32, 33]. Otherwise, in young children and in cases of bilateral abdominal testicles, most surgeons have recommended an orchidopexy[33].

A review of the literature by Sousa et al.[33] reported that of more than 400 pediatric testes (or testicular remnants) found the rate of performed orchidectomies was 16% (68/418), while the rest were descended in a one- or two-stage procedure.

Kirsch et al.[34] documented epididymal abnormalities in 37% of patients with intra-abdominal testes.

In our study there was epididymo-testicular dissociation in one testis in a patient with unilateral undescended testis, biopsy was taken and revealed "streaked gonad" so gonadectomy done two weeks later.

It has been indicated that primary laparoscopic orchidopexy is a feasible and effective technique for the management of low intra-abdominal testes with long vascular pedicle, whereas single stage Fowler–Stevens laparoscopic orchidopexy is recommended in cases with low intra-abdominal testes failed to reach scrotum without division of vessels [5,35].

Occasionally, for an intra-abdominal UDT, greater mobilization of the proximal spermatic cord structures does not provide adequate length to allow tension-free placement of the testes within the scrotum. Greater cord length can be obtained by mobilizing the spermatic vessels medially; a Prentiss maneuver may be performed[36].

In our study, in patient with type III where the testis are near the internal ring but the vas does not loop distally, we routinely test the length of the spermatic cord to determine the potential for successful setting of the testes in their hemi-scrotal side. This test consists of pulling the testis towards the contralateral internal ring; if it reaches there comfortably, there is a high possibility of easy fixation.

Many authors prefer to create it medial to the medial umbilical ligaments, lateral to the bladder and superficial to the pubic symphysis[37,38,17,18].While others create neo-hiatus between the medial umbilical ligament and the inferior epigastric vessels[23,39] avoiding the risk of bladder injury documented in some series [37].

Esposito[40] operate according to the state of internal ring; if the inner inguinal ring is open, a traditional grasping forceps is introduced through the scrotum into the abdomen. If the inner inguinal ring is closed, a neo-hiatus is created medially to the epigastric vessels.

In our study we create a neo-hiatus medial to medial umbilical ligament and lateral to the bladder even if the internal ring is open in 18 patients with intra-abdominal testes treated either by primary laparoscopic orchidopexy or staged traction technique. No bladder injures occurred in our series as we used carful dissection lateral to bladder wall while keeping an eye on the bladder wall, the other 10 patients their testes were manipulated through the inner inguinal ring.

Handa et al., [41] showed that closure of the internal ring after creating neo hiatus in orchidopexy is not necessary. This is supported by Riquelme et al., [42] study which showed that dissection around internal ring will make the hernia space be occupied by scar tissue and the de-peritonealized area will close completely over the internal inguinal ring.

In our study we didn't close open internal ring by sutures and no inguinal hernia appeared in the follow up period (mean 10 months). Many authors recommend simultaneous bilateral abdominal orchidopexy[16 ,43,44]. Other surgeons in cases with bilateral intra-abdominal testes perform the contralateral procedure 3 months later [38].

Some surgeons clipped only one side vessels for the first stage Fowler Stephens procedure. They did not clip the other side and referred the patient to another centre for consideration of microvascular autotransplant surgery [45,46].

In our study patients with bilateral intra-abdominal testes, one of them has bilateral peeping testes, one side operated on by standard inguinal orchidopexy and the other side was deferred for three months and given a report to be operated on inguinally next time. The other two patients who had high intra-abdominal testes bilateral traction was done and in one of them the two testes brought intrascrotally in the 2nd stage while in the other patient the suture cut through in one side so staged Fowler Stevens done in this side and the other side underwent orchidopexy.

In our study there was one patient with solitary testis, bilateral non palpable; right testis vanishing while the left is pelvic, we used traction method for this patient with favorable outcome regarding long term follow up of site and size of testis.

Although the principle is sound, as seen in many examples of tissue expansion and stretch, the high atrophy rate associated with these techniques was probably due to acute and uncontrolled rather than gradual traction[47].

Daher et al.[48], stated that a standard surgical orchidopexy for short pedicled testis without spermatic vessel ligation and fixation of testis by sutures to the scrotum is preferable to the Fowler-Stephens 2-step procedure with less failure, atrophy, or incomplete testicular descent.

In our study high undescended testis was treated by laparoscopic traction (Shehata technique)[47] followed by 2nd stage 3-6 months later.

The main difference between this technique and historical trials at traction is that it allows very gradual and gentle traction allowing elongation without jeopardizing testicular viability.

one testis slipped off the traction stitch and was converted to a staged Fowler-Stephens procedure, this was due to cutting through the tunica.

Except for the need for 3rd operation in one patient no additional complication occurred in remaining patients as intestinal obstruction or internal herniation.

Good testicular position in the scrotum and no atrophy occurs in all testes manipulated by this technique presuming a good alternative to staged Stephens Fowler technique.However, one limitation of our study is the absence of long-term follow-up to assess fertility.

Conclusion

Laparoscopy is the best way to diagnose and manage impalpable undescended testes.For high level undescended testis and when one-stage mobilization is difficult, staged traction orchiopexy (Shehata technique) has excellent results.

Further comparative studies are needed to confirm our findings especially in management of relatively high intra-abdominal testis.Superiority of this technique over Stephens Fowler can't be judged due to small patient number and lack of histological studies.

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